CLAIMS

1. A laser irradiation apparatus comprising:

a laser oscillator;

a slit for blocking an end portion of a laser beam emitted from the laser oscillator;

a condensing lens for projecting an image formed at the slit onto an irradiation surface; and

means for moving the irradiation surface relative to the laser beam.

2. A laser irradiation apparatus comprising:

a first laser oscillator;

a second laser oscillator;

a waveplate for changing a polarizing direction of a first laser beam emitted from the first laser oscillator;

a polarizer for combining the first laser beam and a second laser beam emitted from the second laser oscillator;

a slit for blocking an end portion of the combined laser beam;

a condensing lens for projecting an image formed at the slit to an irradiation surface; and

means for moving the irradiation surface relative to the laser beam.

3. The laser irradiation apparatus according to Claim 1 or 2,

wherein the condensing lens is two convex cylindrical lenses or a spherical

lens.

4. The laser irradiation apparatus according to Claim 3,

wherein the two convex cylindrical lenses are arranged so that their generatrix lines intersect with each other.

5. The laser irradiation apparatus according to Claim 1 or 2,

wherein the laser beam is a continuous wave laser beam.

6. The laser irradiation apparatus according to Claim 5,

wherein the laser beam is emitted from a laser having a medium of a single-crystal YAG, YVO_4, forsterite (Mg_2SiO_4), $YAlO_3$, or $GdVO_4$, or a poly-crystal (ceramic) YAG, Y_2O_3, YVO_4, $YAlO_3$, or $GdVO_4$, each of which is doped with one or a plurality of Nd, Yb, Cr, Ti, Ho, Er, Tm, and Ta as dopant, a solid-state laser such as an alexandrite laser or a Ti:sapphire laser, a gas laser such as an Ar ion laser or a Kr ion laser, or a semiconductor laser such as a GaN laser, a GaAs laser, or an InAs laser.

7. The laser irradiation apparatus according to Claim 1 or 2;

wherein the laser beam has a pulse width of femtoseconds.

8. The laser irradiation apparatus according to Claim 7,

wherein the laser beam is emitted from a Ti:sapphire laser, a chromium-forsterite laser, or a Yb:YAG laser.

9. The laser irradiation apparatus according to Claim 1 to 2,

wherein the laser beam is a pulsed laser beam with a repetition rate of 10 MHz or more.

10. The laser irradiation apparatus according to Claim 7,

wherein the laser beam is emitted from a laser having a medium of a single-crystal YAG, YVO_4, forsterite (Mg_2SiO_4), $YAlO_3$, or $GdVO_4$, or a poly-crystal (ceramic) YAG, Y_2O_3, YVO_4, $YAlO_3$, or $GdVO_4$, each of which is doped with one or a plurality of elements selected from the group consisting of Nd, Yb, Cr, Ti, Ho, Er, Tm, and Ta as dopant, an Ar ion laser, or a Ti:sapphire laser.

11. The laser irradiation apparatus according to Claim 1 or 2,

wherein a width of a microcrystal region in a laser irradiation region formed by the laser irradiation apparatus ranges from 1 to 20 μm.

12. The laser irradiation apparatus according to Claim 1 or 2,

wherein the slit has a blocking plate which is opened and closed.

13. The laser irradiation apparatus according to Claim 1 or 2,

wherein an image at the slit and an image on the irradiation surface are in a conjugated relation by the condensing lens.

14. A method for manufacturing a semiconductor device comprising:

forming a semiconductor film over a substrate;

producing a first laser beam emitted from a laser oscillator into a second laser beam by passing through a slit;

producing the second laser beam into a third laser beam by using a condensing lens;

irradiating the semiconductor film with the third laser beam; and

moving the third laser beam relative to the semiconductor film.

15. A method for manufacturing a semiconductor device comprising:

forming a semiconductor film over a substrate;

combining a first laser beam emitted from a first laser oscillator whose polarizing direction has been changed by a waveplate with a second laser beam emitted from a second laser oscillator by a polarizer, the combined laser beam serving as a third laser beam;

producing the third laser beam into a fourth laser beam by passing through a slit;

producing the fourth laser beam into a fifth laser beam by using a condensing lens;

irradiating the semiconductor film with the fifth laser beam; and

moving the fifth laser beam relative to the semiconductor film.

16. The method for manufacturing a semiconductor device according to Claim 14 or 15,

wherein the condensing lens is two convex cylindrical lenses or a convex spherical lens.

17. The method for manufacturing a semiconductor device according to Claim 14 or 15,

wherein the laser beam is a continuous wave laser beam.

18. The method for manufacturing a semiconductor device according to Claim 17,

wherein the laser beam is emitted from a laser having a medium of a single-crystal YAG, YVO_4, forsterite (Mg_2SiO_4), $YAlO_3$, or $GdVO_4$, or a poly-crystal (ceramic) YAG, Y_2O_3, YVO_4, $YAlO_3$, or $GdVO_4$, each of which is doped with one or a plurality of elements selected from the group consisting of Nd, Yb, Cr, Ti, Ho, Er, Tm, and Ta as dopant, a solid-state laser such as an alexandrite laser or a Ti:sapphire laser, a gas laser such as an Ar ion laser or a Kr ion laser, or a semiconductor laser such as a GaN laser, a GaAs laser, or an InAs laser.

19. The method for manufacturing a semiconductor device according to Claim14 or 15,

wherein the laser beam has a pulse width of femtoseconds.

20. The method for manufacturing a semiconductor device according to Claim 19,

wherein the laser beam is emitted from a Ti:sapphire laser, a chromium·forsterite laser, or a Yb:YAG laser.

21. The method for manufacturing a semiconductor device according to Claim14 or 15,

wherein the laser beam is a pulsed laser beam with a repetition rate of 10 MHz or more.

22. The method for manufacturing a semiconductor device according to Claim 21,

wherein the laser beam is emitted from a laser having a medium of a single-crystal YAG, YVO_4, forsterite (Mg_2SiO_4), $YAlO_3$, or $GdVO_4$, or a poly-crystal (ceramic) YAG, Y_2O_3, YVO_4, $YAlO_3$, or $GdVO_4$, each of which is doped with one or a plurality of elements selected from the group consisting of Nd, Yb, Cr, Ti, Ho, Er, Tm, and Ta as dopant, an Ar ion laser, or a Ti:sapphire laser.

23. The method for manufacturing a semiconductor device according to Claim14 or 15,

wherein a width of a microcrystal region to a laser irradiation region formed by the irradiation ranges from 1 to 20 μm.

24. The method for manufacturing a semiconductor device according to Claim14 or 15,

wherein the slit has a blocking plate which is opened and closed.

25. The method for manufacturing a semiconductor device according to Claim 14 or 15,

wherein an image at the slit and an image on the semiconductor film are in a conjugated relation by the condensing lens.

26. A laser irradiation method comprising:

producing a first laser beam emitted from a laser oscillator into a second laser beam by passing through a slit;

producing the second laser beam into a third laser beam by using a condensing lens;

irradiating an irradiation surface with the third laser beam; and

moving the third laser beam relative to the irradiation surface.

27. A laser irradiation method comprising:

combining a first laser beam emitted from a first laser oscillator whose polarizing direction has been changed by a waveplate with a second laser beam emitted from a second laser oscillator by a polarizer, the combined laser beam serving as a third laser beam;

producing the third laser beam into a fourth laser beam by passing through a slit;

producing the fourth laser beam into a fifth laser beam by using a condensing lens;

irradiating an irradiation surface with the fifth laser beam; and

moving the fifth laser beam relative to the irradiation surface.

28. The laser irradiation method according to Claim 26 or 27,

wherein the condensing lens is two convex cylindrical lenses or a convex spherical lens.

29. The laser irradiation method according to Claim 26 or 27,

wherein the laser beam is a continuous wave laser beam.

30. The laser irradiation method according to Claim 29,

wherein the laser beam is emitted from a laser having a medium of a single-crystal YAG, YVO_4, forsterite (Mg_2SiO_4), $YAlO_3$, or $GdVO_4$, or a poly-crystal (ceramic) YAG, Y_2O_3, YVO_4, $YAlO_3$, or $GdVO_4$, each of which is doped with one or a plurality of elements selected from the group consisting of Nd, Yb, Cr, Ti, Ho, Er, Tm, and Ta as dopant, a solid-state laser such as an alexandrite laser or a Ti:sapphire laser, a gas laser such as an Ar ion laser or a Kr ion laser, or a semiconductor laser such as a GaN laser, a GaAs laser, or an InAs laser.

31. The laser irradiation method according to Claim 26 or 27,

wherein the laser beam has a pulse width of femtoseconds.

32. The laser irradiation method according to Claim 31,

wherein the laser beam is emitted from a Ti:sapphire laser, a chromium-forsterite laser, or a Yb:YAG laser.

33. The laser irradiation method according to Claim 26 or 27,

wherein the laser beam is a pulsed laser beam with a repetition rate of 10 MHz or more.

34. The laser irradiation method according to Claim 33,

wherein the laser beam is emitted from a laser having a medium of a single-crystal YAG, YVO_4, forsterite (Mg_2SiO_4), $YAlO_3$, or $GdVO_4$, or a poly-crystal (ceramic) YAG, Y_2O_3, YVO_4, $YAlO_3$, or $GdVO_4$, each of which is doped with one or a plurality of elements selected from the group consisting of Nd, Yb, Cr, Ti, Ho, Er, Tm, and Ta as dopant, an Ar ion laser, or a Ti:sapphire laser.

35. The laser irradiation method according to Claim 26 or 27,

wherein a width of a microcrystal region to a laser irradiation region formed by the laser irradiation apparatus ranges from 1 to 20 μm.

36. The laser irradiation method according to Claim 26 or 27,

wherein the slit has a blocking plate which is opened and closed.

37. The laser irradiation method according to Claim 26 or 27,

wherein an image at the slit and an image on the irradiation surface are in a conjugated relation by the condensing lens.